No. 778,548. PATENTED DEC. 27, 1904.

W. F. RICE.

CHANGE SPEED GEARING.

APPLICATION FILED JULY 8, 1902.

2 SHEETS—SHEET 1.

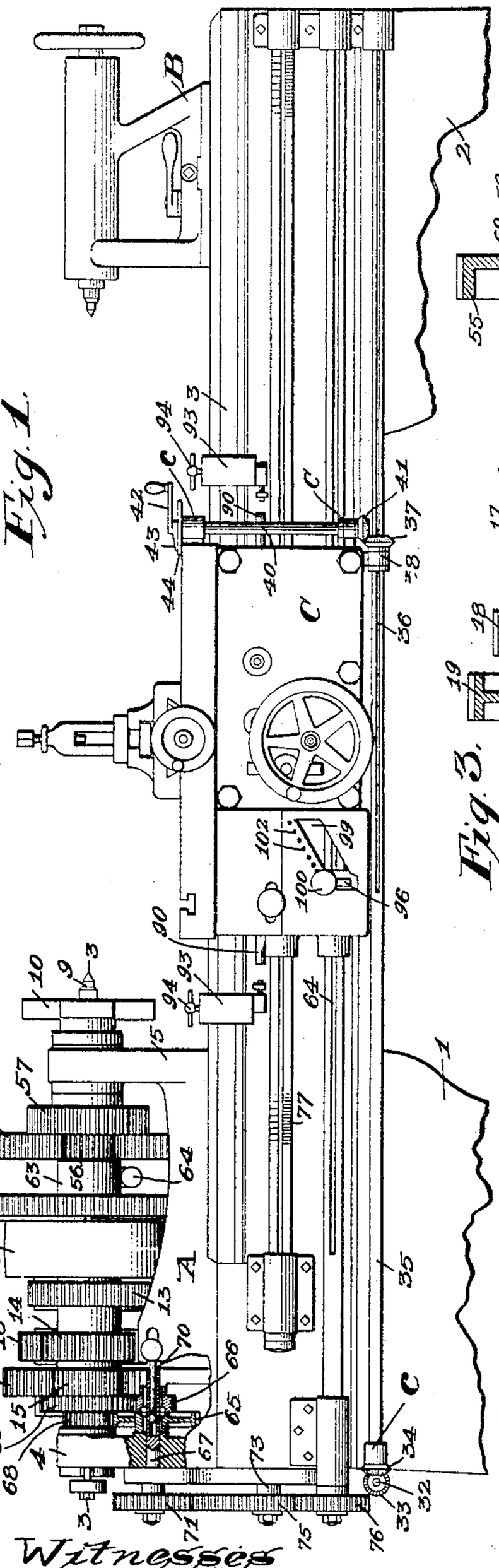

Fig. 1.

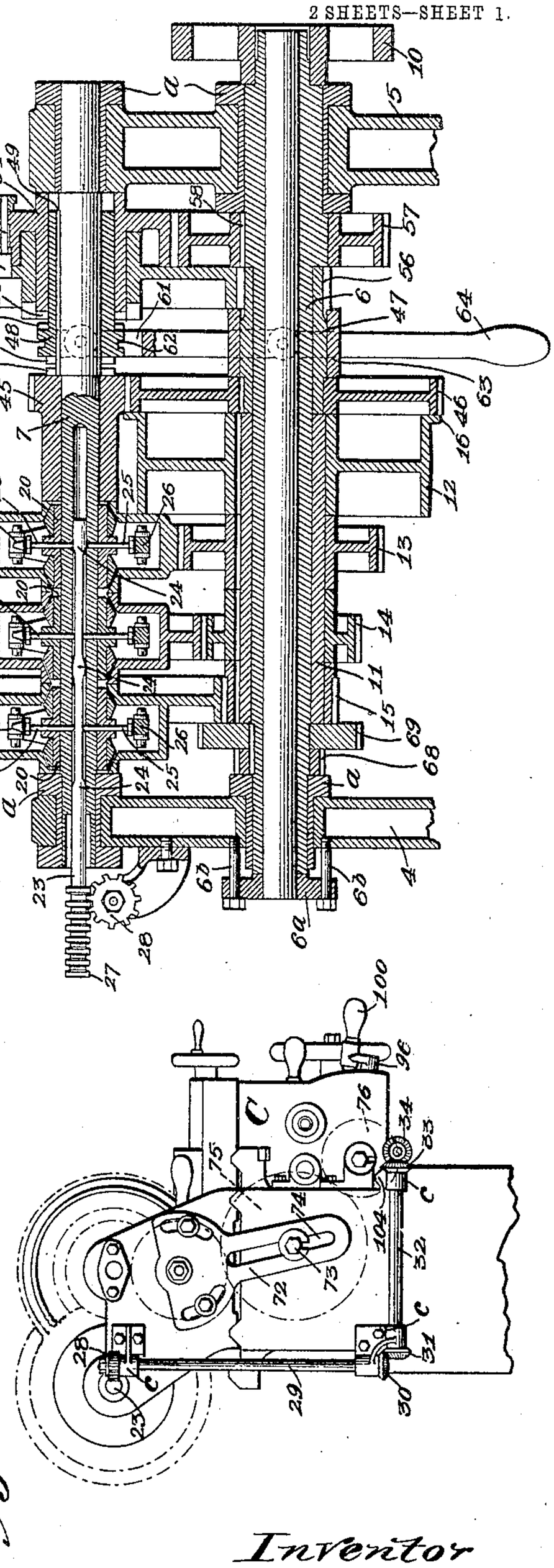

Fig. 3.

Fig. 2.

Fig. 4.

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2 SHEETS—SHEET 2.

Fig. 4.

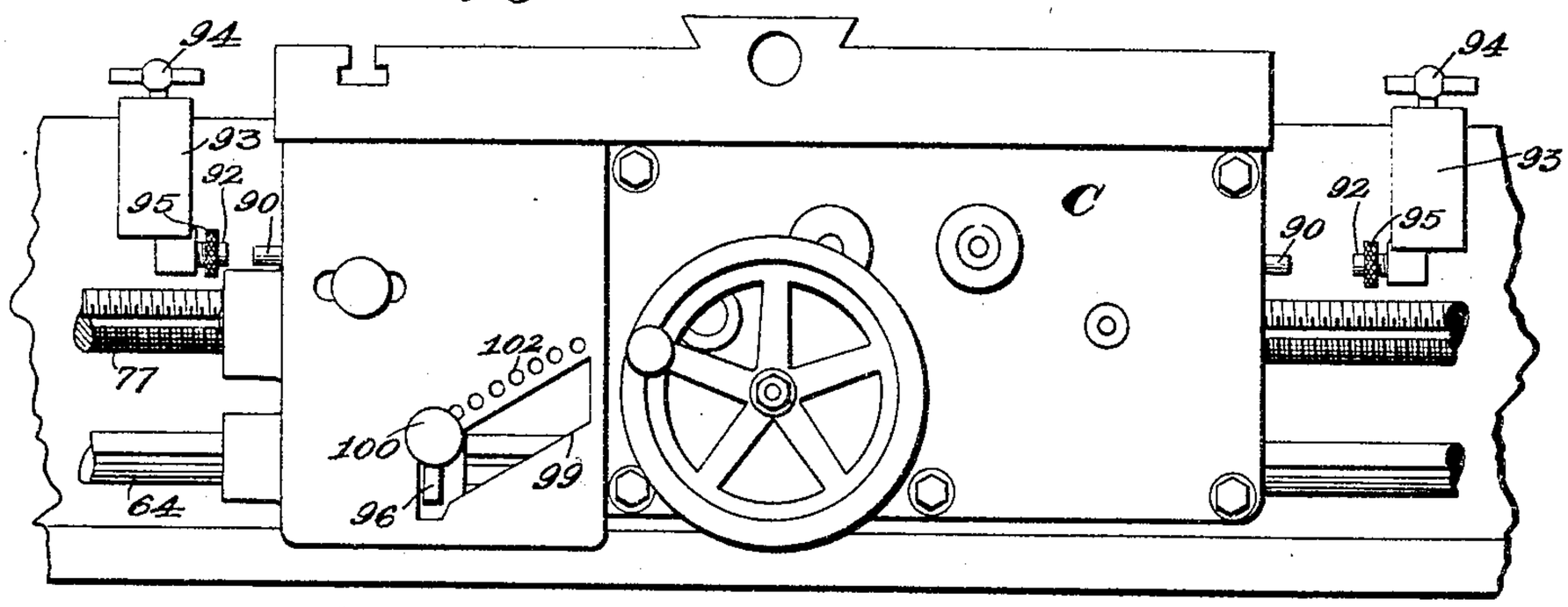


Fig. 5.

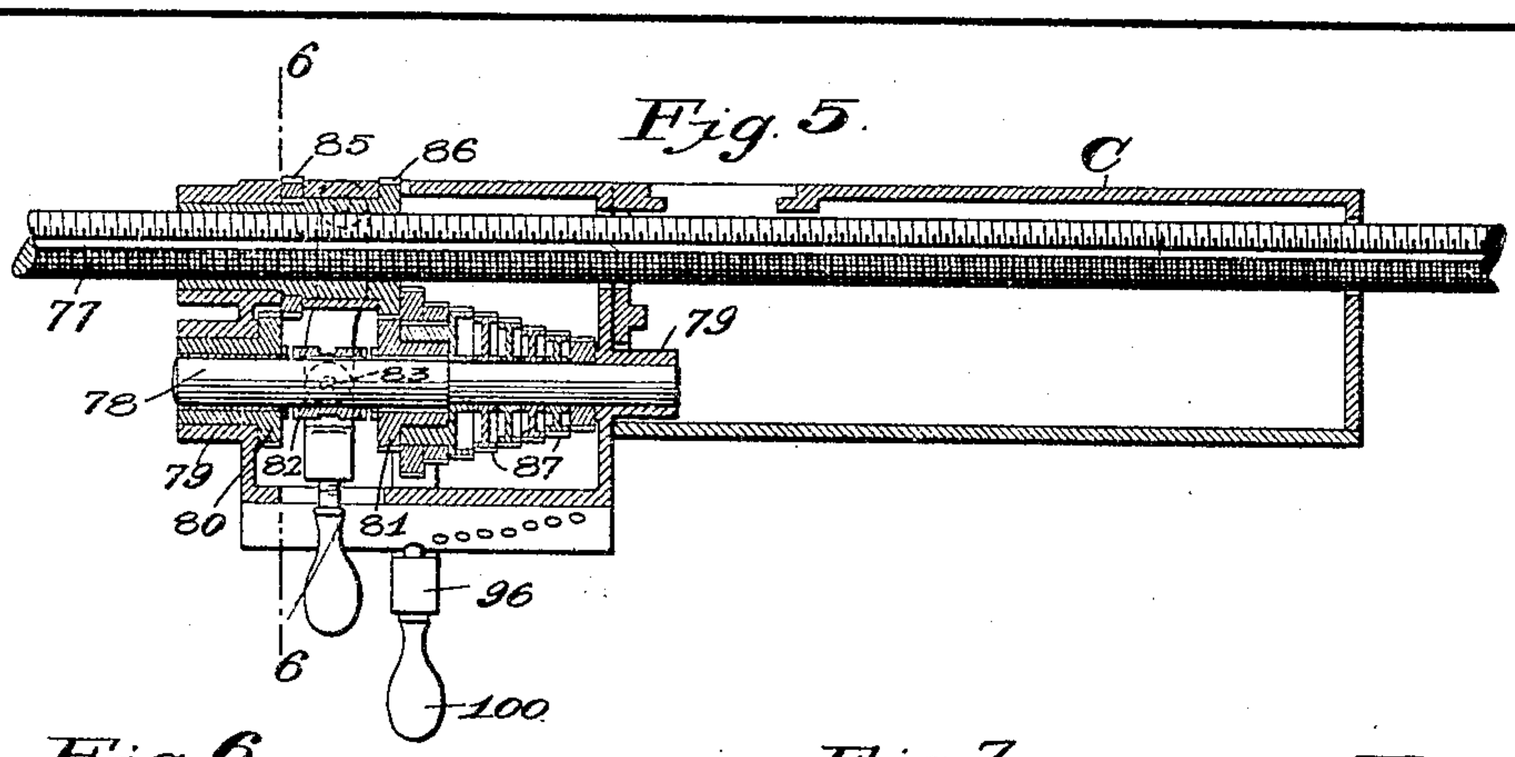


Fig. 6.

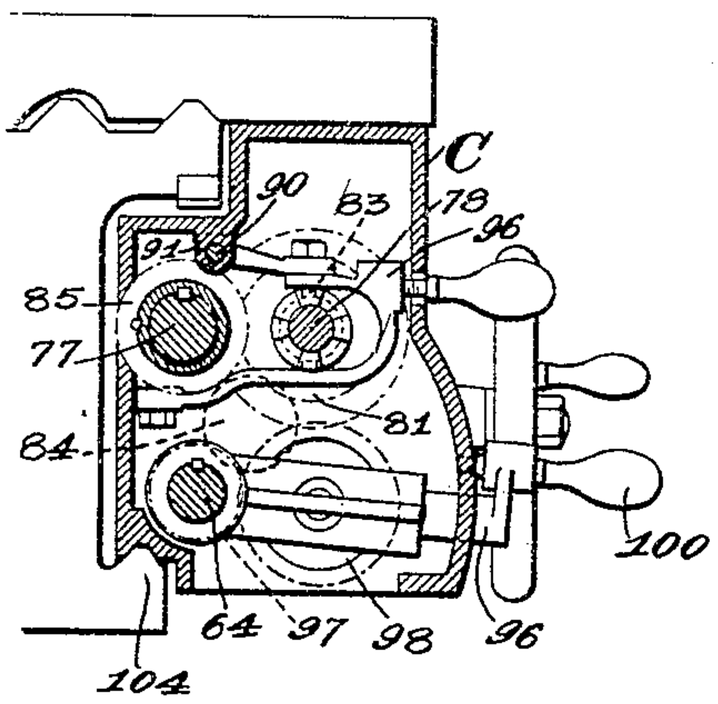


Fig. 7.

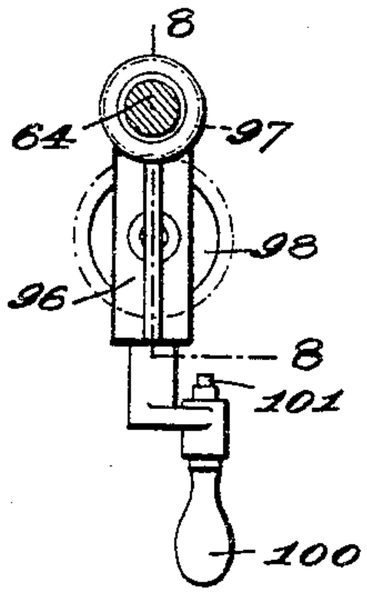
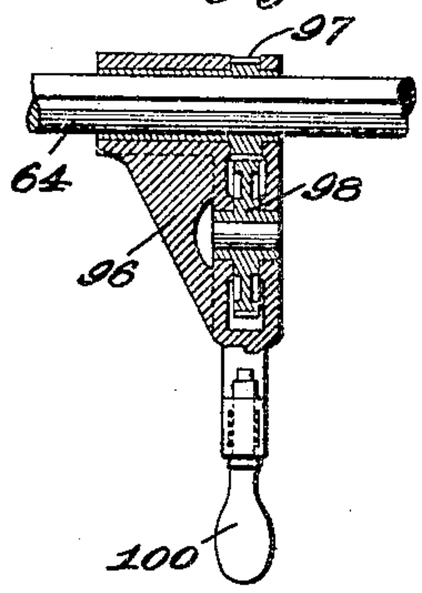


Fig. 8.



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UNITED STATES PATENT OFFICE.

WALTER F. RICE, OF WORCESTER, MASSACHUSETTS.

CHANGE-SPEED GEARING.

SPECIFICATION forming part of Letters Patent No. 778,548, dated December 27, 1904.

Application filed July 8, 1902. Serial No. 114,740.

To all whom it may concern:

Be it known that I, WALTER F. RICE, a citizen of the United States, residing at Worcester, in the county of Worcester and Commonwealth of Massachusetts, have invented a new and useful Improvement in Change-Speed Gearing, of which the following is a specification accompanied by drawings forming a part of the same, in which—

Figure 1 is a view in side elevation. Fig. 2 is an end view. Fig. 3 is a horizontal section on line 3 3, Fig. 1. Fig. 4 is an enlarged view of the carriage looking from one side. Fig. 5 is a horizontal sectional view through the carriage, apron, and mechanism for regulating and varying the speed of the feed-screw. Fig. 6 is a transverse section through the carriage on line 6 6 of Fig. 5. Fig. 7 is a view of bracket 96; and Fig. 8 is a section of same on line 8 8, Fig. 7.

Similar reference letters and figures refer to similar parts in the different views.

The object of my present invention is to provide improved mechanism by which the speed of the live-spindle of a lathe may be varied and the movement of the carriage and of the feed-screw may be controlled by the operator without moving from his station in front of the carriage and without necessitating the stopping of the drive belt. This I accomplish by connecting all of the mechanism for bringing about these changes with the carriage within easy reach of the operator, so they may be manipulated without making any change in his position in front of the machine, where he is at work with his tools.

With these objects in view my invention consists in an assemblage of coöperating elements and mechanism whereby to accomplish the objects mentioned with the use of simple means and as few parts as possible.

Referring to the accompanying drawings, 1 and 2 represent the end frames of the lathe, adapted to be supported in the usual manner upon legs, (not shown,) and these end frames are connected by the usual bed or top plate 3, which is furnished with the V-shaped guides, upon which the head and tail stocks A and B, respectively, and carriage C are supported, the latter being adapted to travel back and forth on these guides after the usual fashion and actuated by means of mechanism which will be hereinafter described. The head-stock A is provided with the usual standards 4 and 5, in which the live-spindle 6 and counter-shaft 7 are revolubly supported, the bushings *a a* being provided for them to turn in. The spindle 6 is adapted to receive the centering device 9 at one end and has the usual face-plate 10 keyed or otherwise secured at that end and to which the work-clamp (not shown) is adapted to be attached in the accustomed manner. The opposite end of the spindle abuts against a thrust-block 6^a, which is adjustably secured to the standard 4 by the bolts or screws 6^b, whereby to sustain the end thrust upon the spindle in active operation. A sleeve 11 is concentrically supported upon a portion of the live-shaft 6, and on this sleeve a drive-pulley 12, as well as the three gear-wheels 13, 14, and 15, of varying diameters, is keyed, the diameters of the latter decreasing in the order named. Around the pulley the drive-belt (not shown) is adapted to extend, the flange 16 acting to prevent the belt from sliding off at that end. The counter-shaft 7 is bored out through its longitudinal center, and on its exterior the gear-wheels 17, 18, and 19 are secured, their diameters increasing in the order named in corresponding proportion to the gear-wheels 13, 14, and 15 on the live-spindle 6, opposite which they are located, respectively, with their teeth intermeshed, and the object of this arrangement is to provide for varying the speed of the live-spindle 6, which turns the work being operated upon. These gear-wheels 17, 18, and 19 are each loosely mounted upon independent sleeves 20, keyed to the counter-shaft 7, and in the hub of each of said gear-wheels 17, 18, and 19 a friction-clutch is located, (see Fig. 3,) and although the details of the clutch constitute no portion of my present invention it may be stated briefly that the gear-wheels 17, 18, and 19, which normally run idly upon the counter-shaft, are clutched thereto when desired by moving the rod 23 endwise in the bore of the counter-shaft 7. This rod has cams 24 24 thereon, one for each of said gear-wheels, although they are located at greater distances apart than said gear-wheels.

These cams 24 24 are adapted to crowd the pins 25 25 outward against the clutch-sections 26 26 to cause the latter to engage the gear-wheels and lock them to the shaft. It is understood, of course, that although I have referred to the gear-wheels collectively only one gear-wheel is clutched to the shaft at a time, and that is why the cams are at greater distances apart than are the gear-wheels, so that when one set of cams is operating upon a clutch the others are out of position. Adjacent to the gear-wheel 17 and the drive-pulley 12 a pinion 45 is loosely mounted upon the shaft 7. The teeth of this pinion 45 are intermeshed with the teeth of a gear-wheel 46, keyed to a sleeve 47, loosely mounted upon the live-spindle 6. A clutch 48 is mounted upon the shaft 7, a key 49 being interposed between it and the shaft to lock it to the shaft and admit of its sliding endwise. This clutch is provided with two series of clutch-teeth 50 and 51, the teeth 50 being adapted to engage the clutch-teeth 52 on the hub of the pinion 45 and the clutch-teeth 51 to engage corresponding teeth 53 on the hub of a gear-wheel 54, which turns upon the sleeve portion of the clutch, as shown in Fig. 3 of the drawings, and the hub of this gear-wheel 54 abuts at one end against the adjacent upright 5. Another and larger gear 55 is mounted upon the hub of the gear-wheel 54, and its teeth are intermeshed with the teeth of a small pinion 56, formed on or otherwise secured to the sleeve 47 on spindle 6, while the teeth of the gear-wheel 54 intermesh with a pinion 57, keyed, a sat 58, upon the spindle 6. Provision is made in the way of a pin 59, which slides in the pinion 54 and is capable of entering a hole 60 in the gear-wheel 55, whereby to lock the two gear-wheels 54 and 55 together. The clutch 48 is slid endwise in the usual manner by means of a shipper 16 operating in the circumferential groove 62 and connected with the lever 64, which is manipulated to change the position of this clutch. Between the gear-wheels 46 and 56 a sleeve 63 is interposed to fill up the space between gear-wheels 46 and 56 and also to afford a stationary member for the pivotal support of lever 64, and the several gear-wheels on the two shafts 6 and 7 are confined between the standards 4 and 5.

The rod 23 may be shifted in any approved manner; but as one convenient method of accomplishing this result I have devised the following: On the outer end the rod is provided with a rack 27, and a gear-wheel 28 is intermeshed with this rack, as shown in Fig. 2. Said gear-wheel 28 is carried upon a vertical shaft 29, which shaft in turn has a bevel-gear 30 on its lower end to intermesh with another bevel-gear wheel, 31, on the horizontal shaft 32. Secured to the opposite end of the shaft 32 is a miter-gear 33, the teeth of which engage the teeth of a similar miter-gear 34 on the longitudinal shaft 35, Fig. 1, which latter shaft preferably extends throughout the length of the machine, all these shafts of course being supported in suitable bearings *c c*. The longitudinal shaft 35 is provided with a spline 36, and a bevel-gear 37, mounted on this shaft, is provided with a key which engages the spline 36, the shank of the gear 37 being revolubly supported in a hanger 38, depending from the carriage C. Carried by the right-hand end of the carriage is a vertical shaft 40, which turns in suitable bearings *c c* provided therefor, and it has a bevel-gear 41 on its lower end intermeshed with the bevel-gear 37. On the upper end of this vertical shaft 40 a speed-controlling crank 42 is secured, by which means the whole series of shafts and bevel gear-wheels described are simultaneously turned in order to slide the rod 23 endwise, and to determine which gear-wheel of the three previously described—that is, 17, 18, or 19—is to be clutched to the shaft 7 the operator simply turns this crank 42 to the right or left. The crank has a pointer 43 on one end, which traverses a dial 44 over the uppermost bearing *c*, as shown in Fig. 1. This dial may be numbered to indicate the speed to be given the live-spindle 6, and the crank is turned until the pointer is opposite the speed the operator desires to attain. So it will be understood that the speed-controller is within easy reach of the operator as he stands in front of the carriage while turning a piece of metal upon the lathe. In this way power is applied to the spindle 6 at the speed desired through the gear-wheels 17, 18, or 19, through the gear-wheels 45, 46, 56, 55, 54, and 57 to the shaft 6, provided the clutch is thrown into the clutch-teeth 52, or it may be applied through the gear-wheels 54 and 57 directly to the shaft when the clutch 48 is thrown over to engage the clutch-teeth 53, according to the speed desired to be imparted to the shaft 6.

The pin 59 is carried by the gear-wheel 54, one end of the pin adapted to be received within the recess or aperture 60 in gear-wheel 55; but it is possible to remove the pin from its engagement with the gear 55, if necessary, in order that the gear 54 may rotate independently of the gear 55 and transmit its movement directly to the spindle 6 through gear 57.

Motion is transmitted to the feed-rod 64 in the usual way through one or the other of the gear-wheels 65 or 66 on the stub-shaft 67, said gear-wheels being intermeshed, respectively, with the teeth of the gear-wheels 68 and 69, keyed upon the live-spindle 6, either one or the other of the gear-wheels 65 or 66 being locked to the stub-shaft 67 by a sliding key-bolt 70. On the outer end of the stub-shaft 67 a gear-wheel 71 is secured, and an adjustable hanger 72 has a bearing-stud 73 adjustably connected therewith through the medium of a slot 74, and on this adjustable stud a large gear-wheel 75 is revoluby sup-

ported, and its teeth are capable of being swung into or out of engagement with the teeth of a pinion 76, secured on the feed-rod 64, and through this medium power is communicated from the live-spindle.

Proceeding now to the description of the means for varying the speed of the feed-screw 77 and the automatic carriage-stop mechanism, attention is called to Figs. 4, 5, 6, 7, and 8, in which Fig. 5 shows a horizontal section through the carriage C. A counter-shaft 78 is supported to turn in bearings 79 79 in the carriage parallel to the position of the feed-screw 77, and on this shaft 78 two independent gear-wheels 80 and 81 are loosely mounted, they being provided with clutch-teeth on their inner faces. Between them a clutch-sleeve 82, keyed to slide on the shaft 78, operates, it being shifted to the right or left by means of a suitable handle engaging the clutch at 83, accordingly as it is desired to clutch one gear-wheel or the other to the shaft 78, and sufficient space being allowed between the sets of clutch-teeth so that when the clutch is in its central position both gear-wheels are unclutched or loose upon the shaft 78. The gear-wheel 81 communicates motion to the gear 86, keyed to slide upon the feed-screw 77, and adjacent to the gear-wheel 81 is a cone-gear or series of gear-wheels 87 87, all keyed to the shaft 78 and decreasing in diameter from left to right, this mechanism being used for varying the speed to be imparted to the feed-screw 77. The feed-screw is reversed through the following train of gears: The gear-wheel 80 intermeshes with an intermediate gear-wheel 84, and through the latter motion is imparted to the gear-wheel 85, keyed on the sleeve of the gear-wheel 86, which has sliding connection with the feed-screw 77. The clutch is thrown into its intermediate position automatically and for this purpose is connected with the rod 90, which is supported and capable of sliding in bearings 91. The outer ends of the rod protrude beyond the ends of the carriage C in position to strike the adjustable buffers 92 on the stops 93, which are set on the bed of the machine by the set-screw 94. The buffers 92 are screw-threaded and by turning the milled ring 95 thereon are given a fine adjustment endwise after the stop 93 has been set in approximate position on the bed of the lathe.

The means for varying the speed of the feed-screw 77 will now be described, and it consists of a bracket 96, having a gear-wheel 97 rotatably supported therein and keyed to slide upon the feed-rod 64, through which motion is imparted to it regardless of the position of the bracket on the carriage C, to which it is connected upon the feed-rod 64. This bracket also carries a transmitting gear-wheel 98, which is driven by the gear-wheel 97 and adapted to be thrown into engagement with any one of the several gear-wheels 87 on the shaft 78, and in order to accomplish this adjustment the outer end of the bracket extends through an inclined slot 99 in the front of the carriage, and the handle 100 has a spring-actuated pin 101 therein in position to be set into one of the holes 102, of which there are as many as there are gear-wheels 87, the spring-pin being placed in the one opposite the gear-wheel into which the transmitting-gear 98 is to be made to mesh. A scale may be provided to indicate just the size of threads to be cut, so that the operator will know where to insert the pin 101 for a certain pitch of thread to be cut. The carriage is supported in the usual manner upon the bed of the lathe and is provided with the usual depending apron, and the lower edge of this apron is guided and supported upon a track 104 in position to receive it.

To briefly review the operation, power is applied to the pulley 12 from any convenient source through a drive-belt, (not shown,) and from this source power is transmitted to the spindle 6, according to the speed desired, through one of the three gear-wheels 17, 18, or 19 by the adjustment of the rod 23 in the hollow shaft 7, which acts to clutch the gear-wheel desired to attain the required speed, and the rod 23 is shifted endwise by turning the crank 42 on the carriage C, which through the shafts 40 36 32 29 and the connecting bevel-gears sets the rod 23 in the required position. Then power is communicated from the shaft 7 to the spindle 6 by setting the clutch on the shaft 7 to the right or left, so that motion is transmitted through the gear-wheels 45, 46, 56, 55, and 57 to the spindle 6 or directly through the gear-wheels 54 and 57 to the spindle, according to the speed desired. The speed of the feed-rod is subject to change in the usual way through the gearing 71, 75, and 76 at the end of the machine, and by changing the size of these gear-wheels, if desired, still other variations of speed may be attained for the feed-rod 64. Motion is imparted to the feed-screw through the gearing in the carriage C, and this may be varied, as explained, by setting the movable transmission-gear 98 into different gear-wheels 87 87, and this feed-screw may be reversed by shifting the clutch into engagement with the teeth on the inner face of the gear 80, and the feed is automatically stopped at either extreme movement of the carriage by the rod 90 striking one of the adjustable buffers 92 on the adjustable stop 93. Thus it will be seen that every part for changing speed of the work and also of the carriage is within reach of the operator without changing his position in front of the carriage.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a change-speed gearing, the combination with a machine-frame, a movable car-

riage, a plurality of shafts, one of which is hollow, a slidable clutch-rod therein, transmission-gears on two of these shafts, clutches on the hollow shaft operated by the clutch-rod, a gear-wheel carried by the carriage and splined to one of the shafts, means on the carriage for turning said gear-wheel, and means for transmitting motion from the last-named shaft to the clutch-rod for operating and controlling the latter.

2. In a change-speed gearing, the combination with a machine-frame, a movable carriage, parallel shafts, intermeshed gearing thereon, the gears on one shaft provided with clutches, said shaft being hollow, and a clutch-rod operating therein for controlling the clutches, of a longitudinal shaft having a gear-wheel keyed thereon at one end of the frame of the machine, a transverse shaft supported at the end of the machine and provided with gears one of which is meshed with the gear on the longitudinal shaft, a vertical shaft having a gear meshing with one of the gears on the transverse shaft, the vertical shaft provided with a gear-wheel which engages a rack on the clutch-rod, a gear-wheel carried by the carriage and splined to the longitudinal shaft, and a vertical shaft carried by the carriage and provided with a gear meshed with the splined gear, and means for turning the vertical shaft.

Dated this 26th day of June, 1902.

WALTER F. RICE.

Witnesses:

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